Audit Report

OFFICE OF THE INSPECTOR GENERAL

WAIVERS AND DEVIATIONS FOR THE C-17 AIRCRAFT

Report No. 97-104

March 6, 1997

Department of Defense

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March 6, 1997

MEMORANDUM FOR ASSISTANT SECRETARY OF THE AIR FORCE
(FINANCIAL MANAGEMENT AND COMPTROLLER)

SUBJECT: Audit Report on Waivers and Deviations for the C-17 Aircraft
(Report No. 97-104)

We are providing this final audit report for your information and use. This is the second in a series of audit reports resulting from our review of the management of contract waivers and deviations. We considered comments on the draft of this report in preparing this final report.

Comments on the draft of this report conformed to the requirements of DoD Directive 7650.3 and left no unresolved issues. Therefore, no additional response is necessary.

We appreciate the courtesies extended to the audit staff. Questions on the audit should be directed to Mr. John E. Meling, Audit Program Director, at (703) 604-9091 (DSN 664-9091) or Mr. Brian M. Flynn, Audit Project Manager, at (703) 604-9076 (DSN 664-9076). See Appendix G for the report distribution. Audit team members are listed inside the back cover.

David Steensma

David K. Steensma
Deputy Assistant Inspector General
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Office of the Inspector General, DoD

Report No. 97-104
(Project No. 6AE-0033.01)

March 6, 1997

Waivers and Deviations for the C-17 Aircraft

Executive Summary

Introduction. The Air Force contracted with McDonnell Douglas Corporation to build and deliver the C-17 aircraft. The aircraft was designed to modernize the airlift fleet and improve the capability of the United States to rapidly project, reinforce, and sustain combat forces worldwide. The Air Force plans to buy 120 C-17 aircraft, of which the contractor has delivered 27. Parts serialization,* a requirement of the contract, provides accountability for critical parts manufacturing information at the time of delivery. Also, the use of parts serialization information, when automated, provides a means for the Air Force to track use of parts throughout the life of the aircraft. Therefore, parts serialization is a key element necessary for aircraft maintenance and fleet management.

Audit Objectives. The primary audit objective was to evaluate the management of contract waivers and deviations for Defense systems. Specifically, we assessed whether procedures for reviewing, approving, and obtaining equitable consideration for major waivers and deviations were adequately and consistently applied. We also reviewed the implementation of management controls applicable to waivers and deviations. The C-17 aircraft is one of six programs reviewed in our ongoing audit of contract waivers and deviations for Defense acquisition systems.

Audit Results. The C-17 System Program Office generally managed contract waivers and deviations in an effective manner. However, we did find that the Air Force cannot readily and fully trace all airframe fracture-critical and landing-gear parts for which the contract required serial numbers on the first 27 C-17 aircraft delivered. As a result, Air Force maintenance burden and costs will increase because the Air Force lacks the means to readily identify some of the critical parts that are on its aircraft and lacks the necessary information on the origin and history of the parts. We consider it a material weakness in the C-17 management control process for contract waivers that procedures were not in place to ensure that the contractor implemented agreed upon corrective actions fully and in a timely manner.

To correct the problems, the contractor proposed that it contact subcontractors to obtain traceability information; require all subcontractors to submit traceability records, which the contractor will maintain; and revise drawings to eliminate misunderstanding of parts serialization requirements. The C-17 System Program Office felt that the contractor had been proactive, citing that the contractor was also assigning serial numbers for the subcontractors to use for parts identification and requiring subcontractors to submit a

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*Serialization is the method of uniquely identifying parts and assemblies that bear common part numbers by marking with nonrepetitious serial numbers. Proper serialization also provides a means of correlating individual parts with associated records of manufacturing; reliability; and test, modification, and calibration data for traceability purposes.

data information log that will provide pedigree information on raw materials. The C-17 System Program Office indicated that corrective actions would also include back-filling and populating the part tracking system with fracture-critical part and serial numbers, assigning contractor serial numbers to all parts for which waivers were granted, and capturing and recording updated serial numbers in the part tracking system for parts for which waivers were granted whenever such serial numbers become accessible through inspection or a maintenance action.

Recommendation. We recommend that the Program Director, C-17 System Program Office, develop time-phased milestones, by aircraft, as to when it will have complete traceability information, serial numbers, and part tracking implemented for all airframe fracture-critical and landing-gear, life-limited parts.

Management Comments. The Program Director, C-17 System Program Office, and the Air Force Program Executive Officer for Tactical and Airlift Programs concurred with the report and established time-phased milestones to implement serialization on future aircraft delivery and backfill data on aircraft already received by the Air Force. See Part I for a summary of management comments and Part III for the complete text.

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Part I - Audit Results

Audit Background

The C-17 aircraft is a four-engine, military heavy-lift long-range transport aircraft with a short take-off and landing capability. The aircraft was designed to modernize the airlift fleet and improve the capability of the United States to rapidly project, reinforce, and sustain combat forces worldwide. The C-17 aircraft provides airlift capability for outsized combat equipment equivalent to the larger C-5 aircraft and provides short-field performance similar to the C-130 aircraft. In August 1981, the C-17 System Program Office selected McDonnell Douglas Corporation to develop the C-17 aircraft.

The C-17 aircraft program achieved initial operational capability in January 1995 when 12 aircraft were deployed at the 437th Air Wing at Charleston Air Force Base in South Carolina. The Defense Acquisition Board approved the C-17 aircraft for Milestone IIIB, full-rate production, in November 1995. At that time, the Defense Acquisition Board approved Air Force plans to procure 120 C-17s. Total research, development, and procurement cost is currently projected at $41.5 billion, in then-year dollars, for the entire 120 aircraft.

The effectiveness of any military force depends in part on the operational readiness of aircraft. One major item to influence an airplane system's operational readiness is the condition of the airframe. The complete airframe includes the fuselage, wing, tail, landing gear, control systems and surfaces, engine mounts, and structural operating mechanisms. The Air Force must establish parts serialization on critical airframe parts to maintain operational readiness and to define aircraft capabilities, condition, and operational limitations of the aircraft. The C-17 System Program Office can minimize impact on operational readiness and potential structural or material problems of critical parts if it identifies life-limited parts of the airframe early in the life cycle. The C-17 System Program Office must also provide a preventive maintenance program for the orderly scheduling of inspections and replacement or repair of identified defective parts.

The Air Force established the Aircraft Structural Integrity Program in July 1969 to apply systematic procedures to an aircraft system to enhance design, diagnose potential or impending structural parts failure, provide a basis for corrective action, and predict operational life expectancy of the airframe parts. Parts serialization is the tool that the Aircraft Structural Integrity Program uses to trace and track parts for fleet management. As a management tool, the Aircraft Structural Integrity Program has demonstrated its value with respect to identifying structural parts weaknesses before the loss of aircraft.

Audit Objectives

The primary audit objective was to evaluate the management of contract waivers and deviations for Defense systems. Specifically, we assessed whether procedures for reviewing, approving, and obtaining equitable consideration for major waivers and deviations were adequately and consistently applied. We also reviewed the implementation of management controls applicable to waivers and deviations.

The C-17 aircraft is one of six programs reviewed in our ongoing audit of contract waivers and deviations for Defense acquisition systems, Project No. 6AE-0033, "Management of Contract Waivers and Deviations for Defense Systems." In Appendix A, we discuss the scope and methodology used to accomplish the objective, as well as management controls and prior audit coverage. See Part I for details on the material weakness in the management control program and Appendix A for the details on our review of the management control program.

Audit Results

The C-17 System Program Office generally managed contract waivers and deviations in an effective manner. In fact, the C-17 System Program Office employed a number of creative and thoughtful uses of contract waivers and deviations. For example, the C-17 System Program Office used most of the waivers and deviations that it granted as a means to accept aircraft that, though not meeting detailed contract specifications, were mission capable. Yet, the C-17 System Program Office required that the contractor correct the reasons for the contract waivers and deviations at a later date.

The C-17 System Program Office also expedited granting contract waivers and deviations by using past average consideration that the Government had received for various categories of waivers and deviations instead of calculating the consideration for each individual waiver or deviation being considered. However, the C-17 System Program Office had not maintained records documenting how the averages had been calculated for each category. We will address the determination of the adequacy of consideration received by the C-17 System Program Office and other program offices in an overall report on contract waivers and deviations.

However, during our audit of contract waivers and deviations for the C-17 aircraft, we did find that the Air Force cannot readily and fully trace all airframe fracture-critical and landing-gear parts for which the contract required serial numbers on the first 27 aircraft delivered. A discussion of that finding and the corrective action taken by the Air Force follows.

Serialization of Fracture-Critical and Landing-Gear Parts

On the first 27 C-17 aircraft delivered, the Air Force cannot readily and fully trace all airframe fracture-critical and landing-gear parts for which the contract required serial numbers. Parts serialization data were not available for the first 17 aircraft received from the contractor. For the last 10 aircraft delivered, parts traceability information was not available for an average of 32 of the 109 airframe fracture-critical parts and 11 of the 20 landing-gear life-limited parts on each aircraft. That condition existed in part because the C-17 System Program Office granted waivers to the contract requirement that airframe fracture-critical and landing-gear parts be marked with serial numbers and that the contractor provide those serial numbers to the Air Force on the first 27 production C-17 aircraft. Further, the C-17 aircraft contract does not require the contractor to deliver all the serial numbers and serialization data to the Air Force. The C-17 System Program Office granted waivers because the contractor:

o accepted parts from subcontractors without serial numbers or assembled the parts into the aircraft without recording serial numbers because of ambiguous contractor instructions, and

o did not always maintain such information at its facility because the contractor did not require delivery of documentation containing information concerning the manufacture of airframe fracture-critical and landing-gear parts for which serial numbers were required.

Further, the C-17 System Program Office was not maintaining information on the specific use and movement of airframe fracture-critical and landing-gear parts. As a result, the C-17 System Program Office lacks the means to readily identify some of the specific parts that are on its aircraft and cannot identify information as to how or by whom the parts were made or the use that they are subjected to as they are employed on and moved from aircraft to aircraft. Without the ability to identify specific parts, their manufacture, and their use by serial number, airframe fracture-critical and landing-gear parts may have to be repaired or replaced prematurely. Those maintenance functions may unnecessarily increase the maintenance burden, and the C-17 fleet could incur unnecessary downtime because the Air Force cannot detect the aircraft on which parts come from defective manufacturing lots or that have lower than expected reliability. In addition, aircraft life appraisal and extension efforts may be more costly without serialization data and serialized parts life tracking.

Serialization Process

Parts Serialization Requirement. On the C-17 aircraft, the C-17 System Program Office and contractor identified 1,280 unique parts that required serialization. Of the 1,280 unique parts identified for serialization, 469 were airframe fracture-critical parts,[1] and 20 were landing-gear reliability-critical parts. Of the 469 airframe fracture-critical parts, 109 are Category A or B fracture-critical parts (parts with little or no redundancy.) All 20 of the landing-gear parts are items that are reliability critical[2] and that could jeopardize crew or passenger safety or significantly affect the overall mission of the C-17 aircraft. The C-17 aircraft contract requires the contractor to serialize the airframe fracture-critical and landing-gear parts. However, the contract did not require the contractor to provide the part serial numbers and associated manufacturing records to the Government for traceability purposes.

Traceability Through Serialization. Serialization enables traceability of fracture-critical parts fabricated from plate, extrusion, and sheet material from a unique raw material supplier's production lot to unique factory serial numbers. Parts fabricated from forging material are traceable from a unique supplier's qualified forging stock lot to unique aircraft factory serial numbers.

Identification Plates and Documentation of Production Actions to Serialize Parts. Each identification plate contains a serial number that identifies the manufacturer who initiated the fabrication of the part and documentation for production materials and actions. Once assigned, the serial number for a part remains unchanged. If a part undergoes further production actions, the initial manufacturer must transfer the production documentation to subsequent production contractors. Subsequent production contractors must record their production actions in the documentation that accompanies the part. To maintain permanent serialized part traceability, all subcontractors must complete the production documentation and identify themselves using the Government unique identification numbers assigned to each manufacturer.

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[1]Fracture-critical parts and components are those for which failure could cause direct loss of the aircraft. Appendix B provides additional information on the categories of fracture-critical parts.

[2]Although the C-17 System Program Office does not classify landing-gear parts as safety of flight or fracture-critical, the landing-gear parts have not demonstrated in tests sufficient reliability levels that they can be relied on to meet their overall life goal without significant supportability costs. So, the parts are classified as life-limited gear. Because the C-17 System Program Office considers the landing-gear parts to be reliability critical, it requires that the contractor serialize the parts.

Contract Serialization Information Requirements

The Air Force cannot readily and fully trace all airframe fracture-critical and landing-gear parts for which the contract required serial numbers on the first 27 C-17 aircraft delivered. For the first 17 C-17 aircraft delivered, the contractor did not know the number of airframe fracture-critical parts for which it had traceability documentation, but indicated that with some effort it could determine the number and could retrieve or reconstruct the documentation. For aircraft numbers 18 through 27, the contractor did not have traceability documentation for an average of 32 of the 109 airframe fracture-critical parts for which the contract required parts serialization information. Furthermore, the contractor did not have data available to verify that the parts were serialized. The Air Force can realize the value of parts' serial numbers in the Aircraft Structural Integrity Program only if the Air Force records and tracks the parts' serial numbers and if traceability data associated with each serial number are readily retrievable. Appendix C provides a breakout of parts serialization data available for airframe fracture-critical parts on aircraft numbers 18 through 27.

The C-17 System Program Office did not classify C-17 aircraft landing-gear parts as safety of flight or fracture-critical because it felt that their failure would not cause direct loss of the aircraft. However, the C-17 System Program Office felt that landing-gear parts were sufficiently critical in that a one life-time confidence level for a part could only be achieved by analytically demonstrating four life-times of use and by testing the part to four life-times of use in the laboratory. The C-17 System Program Office considered landing-gear parts to have their life limited to one fourth of the testing that the parts had undergone. Accordingly, the C-17 System Program Office considered landing-gear parts to be fatigue critical or reliability critical and required parts serialization even though the parts were not considered to be fracture-critical. The contractor, therefore, required the serialization of all 20 landing-gear, life-limited parts on each C-17 aircraft. For the first 17 C-17 aircraft delivered, however, the contractor did not have serial number traceability information available for the 20 landing-gear parts. For aircraft numbers 18 through 27, the contractor had not reported serial numbers for 11 of the 20 landing-gear parts to the C-17 System Program Office.

Serialization Waivers

The C-17 System Program Office granted waivers to the contract serialization requirement on the first 27 production C-17 aircraft. The contractor agreed to implement action to correct the reasons that waivers were necessary, beginning with the first production aircraft. Those actions were listed on each of the 27 contractor waiver requests. However, the contractor has yet to fully implement those corrective actions. The contractor cited two reasons why waivers were requested on each of the 27 C-17 aircraft. Contractor personnel stated that waivers were necessary because subcontractors furnished parts without serial numbers or contractor personnel did not record serial numbers

before assembling the parts into aircraft locations where the numbers were no longer readily visible. The C-17 System Program Office further explained that subcontractors did not put serial numbers on fracture-critical parts because of misunderstanding and misinterpretation of the ambiguous drawing serialization requirements. Also, the contractor did not always maintain such information at its facility because the contract did not require the contractor to deliver serial number traceability documentation concerning the manufacture of airframe fracture-critical and landing-gear parts for which serial numbers were required.

Effect on Maintenance Data System

Once the Air Force takes ownership of the C-17 aircraft, maintenance personnel track serialized parts in the maintenance data system, the Computer-Aided Maintenance System for Airlift, or the G081 System. The C-17 production contract requires the contractor to provide the C-17 System Program Office automated data of part serial numbers for each aircraft when the aircraft is delivered. The C-17 System Program Office uses the automated data to record the serialized parts in the G081 System. The maintenance personnel then use the G081 System to track use of serialized parts for the C-17 engine, airframe, and landing gear. The tracking of parts enables the C-17 System Program Office to enforce contract requirements, determine life consumption, and perform other maintenance data functions.

While the C-17 aircraft contract requires the serialization of parts, it does not require the contractor to deliver all the serialization data for entry into the G081 System. Fracture-critical parts are not included in the requirements for automated data. As a result, the C-17 System Program Office will not be able to initiate the tracking of the fracture-critical parts, when necessary. Consequently, when maintenance personnel move fracture-critical parts from one aircraft to another, the Air Force has no way of tracking and maintaining oversight of a part's location and use.

The contractor should include fracture-critical parts in the automated data delivery as quickly as possible because the C-17 aircraft is already experiencing some movement of fracture-critical airframe parts and anticipates the movement of life-limited, landing-gear parts. C-17 wing flaps are being interchanged from aircraft to aircraft to accommodate fleet operations and the production line as a result of the wing-flap redesign. The interchange of the wing-flaps also necessitates the movement of the fracture-critical inboard flap-support assembly from aircraft to aircraft. In addition, the C-17 Landing Gear Design Review Team identified problems with a landing-gear bearing and the material used in manufacture of a landing-gear bolt. Correction of those problems will require movement of the landing-gear parts to minimize downtime of the aircraft. As the fleet of C-17s age, a greater degree of fracture-critical and life-limited parts interchangeability is likely to occur, as was the case with the C-130 and C-141 aircraft. Appendix D provides historical examples of the movement of fracture-critical and life-limited parts on the C-130 and C-141 aircraft and the heavy maintenance burdens that could have been reduced by serializing and

tracking parts in the G081 System. Because the C-17 contractor was considering corrective action to ensure acquisition of traceability information, this report does not recommend inclusion of fracture-critical parts in the automated data delivery.

Attempting to characterize the flight hour use of individual parts based on aircraft use is not sufficient because parts that are moved from aircraft to aircraft do not have the same use as the aircraft. Although C-17 aircraft fracture-critical and life-limited parts are not intended to be interchanged, they already have been interchanged, as demonstrated by the inboard flap-support assembly and the planned movement of landing-gear parts to correct problems with the landing-gear bearings and bolts. The flap redesign and retrofit program involved a series of four engineering changes that required the removal and upgrade of all designated flaps. The reality of procuring, operating, and maintaining a fleet of aircraft of the nature of the C-17 will require interchanging fracture-critical and life-limited parts. Therefore, the C-17 program can proactively institute individual aircraft part tracking to include serialized parts in the G081 System, and avoid falling into a reactive mode as was the case of the C-130 and C-141 aircraft programs.

The ability to trace parts to determine who made them, what materials were used in their manufacture, and the processes by which they were made is vitally important. Without such ability, maintenance personnel would have to physically inspect each aircraft to locate the suspect parts in the event that the contractor or a subcontractor reported suspect parts to the Air Force based on serial number or manufacturing lot. The C-17 System Program Office has required the contractor to generate all the necessary data to enable the Air Force to accomplish an integrated tracing and tracking system for the C-17 aircraft. With minor adjustments to the Aircraft Structural Integrity Program and maintenance data systems, the Air Force can also track the use and damage hours of all fracture-critical and life-limited serialized parts. Appendix E provides additional information on the Aircraft Structural Integrity Program and part tracking.

Reason That the Air Force Considered Waivers Necessary and Our Audit Response

The C-17 System Program Office stated that it decided to approve the waivers because:

o the majority of subject parts could be traced through applicable build records,

o the contractor initiated corrective actions to meet the contract serialization requirements, and

o the benefit of enforcing the contract requirement for serializing all airframe fracture-critical parts did not warrant the cost of marking parts because

the parts could be traced by other means, and most of the parts in question are not replaceable or removable in the field. Of the 109 Category A and B fracture-critical parts on each aircraft, 8 parts have been removed or interchanged on a limited number of aircraft (aircraft 1 through 18) as a result of the flap redesign and retrofit program that is only applicable to those aircraft. That program is complete and, as a result, future flap change outs or movement is anticipated to be minimal, and tracking records will be maintained.

In granting the waivers, the C-17 System Program Office could not fully quantify, at time of aircraft acceptance, the ramifications on the maintenance burden for the first 27 C-17 aircraft delivered. Our responses to the reasons for the waivers follow.

Information Traceability. Alternative traceability information is incomplete. As the C-17 System Program Office notes, not all of the fracture-critical parts can be traced through applicable build records. In addition, full traceability information, which the Air Force paid for under the contract terms, cannot be obtained through applicable build records. The records may identify portions of the required traceability information, but they do not fully identify a part's raw materials; manufacturer; manufacturing process; predicted reliability; and calibration, test, and modification data.

Adequacy of Corrective Actions. Corrective actions do not fully remedy parts already accepted with waivers. Corrective actions specified in the 27 waiver documents for the first 27 C-17 aircraft state that drawings were being revised to include serialization requirements; assembly instructions were being revised to ensure that serial numbers were recorded as the parts were installed on the aircraft; and parts that had been installed without serial numbers would be marked during normal maintenance or when a modification was made. While those corrective actions do remedy parts of the problem, they do not provide complete traceability information and parts marking for the aircraft already accepted with waivers. The contractor needs to obtain and record pedigree information that will enable traceability on parts that are in the G081 System.

Cost-Effectiveness of Serialization. The Air Force considered serialization to be cost-effective at the time of contract award for full scale engineering development, and the contractor included the requirement in its stated price. The C-17 System Program Office has clearly identified technical requirements for marking parts with serial numbers in its production contracts and has already paid for the cost of serialization in those contracts. We could not break out contract serialization costs; however, the benefits of serializing parts are immense as demonstrated on other aircraft programs, such as the C-130 and C-141 aircraft programs. The problems encountered with the C-130 and C-141 aircraft programs have proven that serialization and the tracking information that they entail are essential for cost-effective fleet maintenance, life appraisal, and life extension (Appendix D). The expense of maintenance, life appraisal, and life extension for the aircraft were significantly increased because of the lack of serialization and part tracking information. Accordingly, we disagree with the Air Force assertion that the benefits of serialization do not warrant the cost of marking parts because the parts can be traced by other means.

Sufficiency of Consideration for Waivers. The C-17 System Program Office accepted $40,510 as consideration for granting 27 contractor waivers for the first 27 aircraft. Appendix F lists the consideration received, an average of only $1,500 per aircraft, for waivers of parts serialization requirements for the 27 aircraft. We doubt that the $40,510 received as compensation for approving the 27 waivers of the parts serialization requirement will suffice to cover the cost of recreating the traceability information. As previously noted, the contractor did not know exactly how much traceability information it lacked on the first 17 production aircraft, and Appendix C identifies the traceability information lacking on aircraft numbers 18 through 27.

Cost-Effectiveness and Availability of Traceability Information. Traceability information after assembly is expensive and perishable. Traceability information, which is part of the serialization process, can only be obtained at considerable expense, if at all, after parts are manufactured and assembled into aircraft. Many traceability records for C-17 parts are currently kept at subcontractor facilities and could be lost permanently, especially if such suppliers are replaced. We were told by the prime contractor that negotiations are ongoing to try to obtain traceability records for parts already installed in aircraft. However, the contractor stated that because contracts with subcontractors did not always require the retention of traceability records, the contractor will incur additional expense to obtain such information, if it is still available.

Mobility of Fracture-Critical Parts. Fracture-critical parts are already being moved between aircraft. The C-17 aircraft is currently experiencing some movement of fracture-critical parts as a consequence of a wing-flap redesign. C-17 aircraft maintenance personnel are interchanging wing flaps from aircraft to aircraft to accommodate fleet operations and the production line as a result of the wing-flap redesign. Movement of the wing flaps resulted in movement of fracture-critical inboard-flap assembly between C-17 aircraft. As the fleet of C-17s age, a greater degree of parts interchangeability is likely to occur as was the case with the C-130 and C-141 aircraft. Despite the fact that the original intent was not to move fracture-critical parts among C-17 aircraft, experience on similar aircraft has shown that the effective maintenance and operation of such a fleet of aircraft will require moving fracture-critical parts. The C-17 aircraft program has already begun to experience movement of parts.

Establishment of Tracking Records. The C-17 System Program Office has not yet established a method to track individual fracture-critical parts for C-17 aircraft. The Air Force can use the G081 System to track the parts, but the C-17 System Program Office has not yet entered the fracture-critical parts into the G081 System.

Conclusion

The C-17 System Program Office generally managed contract waivers and deviations in an effective manner. The Air Force had the foresight to identify

and serialize fracture-critical C-17 parts, establish the Aircraft Structural Integrity Program, and establish the maintenance data system. For earlier aircraft, such as the C-130 and C-141, the Air Force had to integrate data retroactively after the introduction of the aircraft and created maintenance burdens that could have been reduced by serializing and tracking parts. The Air Force now has the opportunity to proactively obtain and integrate data for C-17 aircraft as they enter the fleet; however, it is not doing so. Exploitation of that opportunity would allow the C-17 System Program Office to reduce C-17 aircraft maintenance burdens through more efficient and cost-effective maintenance and fleet management.

Management Actions

The C-17 contractor acknowledged the existence of problems with airframe fracture-critical and landing-gear part serialization. The contractor indicated that he was considering a number of corrective actions, which included:

o contacting subcontractors to obtain traceability information;

o requiring all subcontractors to submit traceability records, which the contractor will maintain; and

o revising drawings and related documents to eliminate misunderstanding and misinterpretation of serialization requirements.

The C-17 System Program Office felt that the contractor had been proactive, citing that the contractor was also assigning serial numbers for the subcontractors to use for parts identification and requiring subcontractors to submit a data information log that will provide pedigree information on raw materials.

The C-17 System Program Office was taking action to determine the specific impact of serialization waivers and indicated that corrective actions would include:

o back-filling and populating the G081 System with fracture-critical part and serial numbers,

o assigning contractor serial numbers to all parts for which waivers were granted, and

o capturing and recording updated serial numbers in the G081 System for parts for which waivers were granted whenever such serial numbers become accessible through inspection or a maintenance action. In the event that a part is found to have no marked serial number, the part will be marked with the serial number assigned by the contractor.

The corrective actions, if implemented, will resolve serialization and tracking problems. A number of the proposed corrective actions have been included as conditions of the waivers granted to the contractor since the first waiver on March 25, 1992. Yet waiver of the serialization requirement was still necessary for aircraft 27 on July 3, 1996. Consequently, we believe that the C-17 System Program Office needs to ensure timely implementation of the corrective actions especially when information is perishable, as in the case of traceability information not currently in the possession of the contractor and information on the extent and nature of parts use not currently being recorded.

Recommendation, Management Comments, and Audit Response

We recommend that the Program Director, C-17 System Program Office, develop time-phased milestones by aircraft as to when it will have complete traceability information, serial numbers, and part tracking implemented for all airframe fracture-critical and landing gear, life-limited parts.

Management Comments. The Program Director, C-17 System Program Office, and the Air Force Program Executive Officer for Tactical and Airlift Programs concurred with the report and established time-phased milestones to implement serialization on future aircraft delivery and backfill data on aircraft already received by the Air Force. The C-17 System Program Office also provided comments to clarify specific information in the finding.

Audit Response. We consider the management comments to be fully responsive and commend the Air Force Program Executive Officer for Tactical and Airlift Programs and the Program Director, C-17 System Program Office, for their responsive actions. We have made revisions to the finding as appropriate based on the clarifying comments provided by the C-17 System Program Office. The comments and our responses are in Part III.

Part II - Additional Information

Appendix A. Scope and Methodology

Scope

We conducted this audit from March through October 1996, and we reviewed data dated from August 1981 through July 1996. To accomplish the objective, we:

o examined contracts F33657-81-C-2108, F33657-89-C-0001, F33657-92-C-0030, F33657-92-C-0031, and F33657-92-C-0037, including statements of work, contract modifications, and related correspondence;

o reviewed requests for deviations and waivers for C-17 aircraft numbers 18 through 27 and related Configuration Control Retrofit Status reports;

o examined delegations of duties and processes in memorandums of agreement and flowcharts, and

o discussed issues relating to the management of contract waivers and deviations with program, technical, and contracting officials.

Methodology

We conducted this program audit in accordance with auditing standards issued by the Comptroller General of the United States, as implemented by the Inspector General, DoD, and accordingly included such tests of management controls as we deemed necessary. We had technical support from the Engineering Branch, Technical Assessment Division, Audit Planning and Technical Support Directorate of the Office of the Assistant Inspector General for Auditing, DoD. We did not use computer-processed data or statistical sampling procedures for this audit.

Contacts During the Audit. We visited or contacted individuals and organizations within the DoD and McDonnell Douglas Corporation, Long Beach, California. Further details are available upon request.

Management Control Program

Requirement for Management Control Review. DoD Directive 5010.38, "Internal Management Control Program," April 14, 1987,* requires DoD organizations to set up a comprehensive system of management controls that provides reasonable assurance that programs are operating as intended and to evaluate the adequacy of the management controls.

Scope of Review of the Management Control Program. We limited our review because of relevant coverage in Inspector General, DoD, Report No. 96-028, "Implementation of the DoD Management Control Program for Major Defense Acquisition Programs," November 28, 1995. The report discusses the effectiveness of the management control program that the Defense Acquisition Executive and the Component Acquisition Executives used for major Defense acquisition programs. The report concludes that the acquisition community had not effectively integrated DoD Management Control Program requirements into its management assessment and reporting processes. As a result of the report recommendations, the Under Secretary of Defense for Acquisition and Technology integrated DoD Directive 5010.38 requirements into the March 15, 1996, revisions to DoD Directive 5000.1, "Defense Acquisition," and DoD Regulation 5000.2-R, "Mandatory Procedures for Major Defense Acquisition Programs (MDAPs) and Major Automated Information System (MAIS) Acquisition Programs," March 15, 1996. Acquisition managers are now to use program cost, schedule, and performance parameters as control objectives to carry out the DoD Directive 5010.38 requirements. The managers are to identify material weaknesses through deviations from approved acquisition program baselines and exit criteria in the "Defense Acquisition Executive Summary" report. Consequently, we limited our review of management controls to those related to contract waivers and deviations for the C-17 program.

Adequacy of Management Controls. We identified a material management control weakness, as defined by DoD Directive 5010.38, in the C-17 management control process for contract waivers and deviations. Management controls were not adequate to ensure that temporary waivers of requirements for mandatory serialization of fracture critical parts were corrected within a reasonable period of time. The Recommendation in this report, if implemented, will improve the C-17 System Program Office management controls. A copy of the report will be provided to the senior official responsible for management controls in the Office of the Assistant Secretary of the Air Force (Financial Management and Comptroller).

*DoD Directive 5010.38 has been revised as "Management Control (MC) Program," August 26, 1996. The audit was performed under the April 1987 version of the directive.

Adequacy of Management's Self-Evaluation. The C-17 System Program Office did not identify contract waivers and deviations as an assessable unit and, therefore, did not identify or report the material management control weakness identified by the audit.

Summary of Prior Audits and Other Reviews

During the last 5 years, the General Accounting Office; the Inspector General, DoD; and the Air Force Audit Agency have not issued reports on the C-17 aircraft program addressing waiver and deviation issues.

Appendix B. Airframe Fracture-Critical Parts

Damage tolerance requirements apply to all safety of flight structure. Fracture critical parts are a subset of safety of flight structure parts and components.

Safety of flight or fracture-critical parts and components are those whose failure could cause direct loss of the aircraft. Safety of flight or fracture-critical parts have additional safety margins to satisfy damage tolerance requirements.

McDonnell Douglas Corporation defines fracture-critical part and component categories as:

o assemblies with little or no redundancy, whose failure is not readily inspectable (Category A),

o assemblies with little or no redundancy, whose failure is readily inspectable (Category B),

o assemblies with significant redundancy, whose failure is not readily inspectable (Category C), and

o assemblies with significant redundancy, whose failure is readily inspectable (Category D).

As defined above, the first two fracture-critical parts and components categories are of the greatest concern. Included in the categories are the airframe fracture-critical parts that the C-17 System Program Office contractually required the contractor to serialize.

In accordance with contract requirements, C-17 System Program Office and contractor personnel identified 469 airframe fracture-critical parts. Of the 469 airframe fracture-critical parts, 109 are Category A or B. The Air Vehicle Specification requires serialization and traceability for all Category A and B fracture-critical parts.

Appendix C. Serialization of Airframe Fracture-Critical Parts on Aircraft 18 Through 27

Aircraft Number:	18	19	20	21	22	23	24	25	26	27
Number of Category A and B fracture-critical parts	109	109	109	109	109	109	109	109	109	109
Number of parts for which serialization was waived	5	6	5	11	8	5	10	5	6	4
Number of parts for which traceability data were not available at contractor's facility*	34	32	45	32	32	35	28	28	27	32

*The contractor had an average number of 32 out of 109 parts for which traceability data were not available on aircraft 18 through 27.

Appendix D. Historical Examples of Serializing and Tracking Parts on the C-130 and C-141 Aircraft

Lack of Traceability, Serialization, and Tracking Information Increases Maintenance Burdens

C-130 Aircraft. During a production inspection, the contractor identified a production lot of defective fracture-critical propellers that were not properly manufactured and were considered unsafe. The Air Force issued Technical Order 1C-130-1358, "Inspection of All C-130 Aircraft Propellers," June 20, 1990, to determine the aircraft on which the defective propellers were installed. Air Force maintenance personnel had to inspect the entire fleet of 680 aircraft, each with 4 propellers, within 10 days to identify the location of the defective propellers. Maintenance personnel had to replace the suspect propellers within the 10 days or down the aircraft until they completed the maintenance function. If the Air Force had tracked the serial numbers, then it could have readily identified the aircraft with the defective propellers. The Air Force has since developed a maintenance data system that can track serialized parts to a tail number.

C-141 Aircraft. During a production inspection, the contractor found that a tooling process had rendered fracture-critical landing gear pins in a specific lot unsafe. As a result, the Air Force issued Technical Order 1C-141-764, "Ultrasonic Inspection of Main Landing Gear Support Shaft," May 7, 1990. Air Force maintenance personnel had to inspect the entire fleet of 220 aircraft within 30 days to identify the aircraft with the suspect pins. Maintenance personnel had to replace the suspect pins within the 30 days or down the aircraft until they completed the maintenance function. If the Air Force had tracked the pins by serial numbers, it could have readily identified and inspected only the aircraft with the suspect pins. The Air Force has available maintenance data systems, such as the G081 System, that can track serialized parts to an aircraft tail number.

Serialized Parts Life Tracking - A System Developed Reactively, Not Proactively

C-130 Aircraft. The C-130 fleet consists of 680 aircraft in several models of varying ages. The Air Force Materiel Command has determined that effective management and use of the C-130 fleet require the interchangeability of structural parts between C-130 aircraft. The C-130 aircraft has five

interchangeable structural sections that are fracture-critical: a vertical stabilizer, a horizontal stabilizer, outer wings, propellers, and landing gear. Because of the large number and varying ages of the fracture-critical structural sections, the Air Force Materiel Command issued technical orders to capture serial number data to initiate tracking to accumulate information on the age and severity of use of structural parts of its C-130 aircraft. Because of multiple problems encountered, such as the maintenance examples previously stated, the Air Force Materiel Command initiated C-130 serialized part tracking with respect to location (aircraft tail number) and life consumption. The Air Force is using the Aircraft Structural Integrity Program to do the tracking.

C-141 Aircraft. The C-141 aircraft has four interchangeable structural sections that are fracture-critical: landing gear, pylons, horizontal stabilizer, and vertical stabilizer. For both the C-130 and the C-141 aircraft programs, fracture-critical structural parts are tracked by serial number. Those parts were not tracked by serial number at the beginning of the programs. To manage the fleet, maintain the aircraft, and extend operational life, the C-130 and C-141 aircraft programs retroactively developed serialized part tracking.

Appendix E. Aircraft Structural Integrity Program and Individual Part Tracking

Aircraft Structural Integrity Program. The Air Force established the Aircraft Structural Integrity Program to systematically diagnose potential or impending structural failure, provide a basis for corrective action, and predict operational life expectancy of the airframe. The Aircraft Structural Integrity Program has demonstrated its value with respect to identifying structural weakness before loss of aircraft and effective management of fleet assets with respect to maintenance and life extension on numerous airframes. Aircraft Structural Integrity Program life surveillance methodologies and procedures form an inherent and valued element of the overall approach to the Air Force aircraft development and operation.

The Aircraft Structural Integrity Program provides an overall guide for accomplishing the various structural life assessment and surveillance elements throughout the life cycle of aircraft. The Air Force requires a structural integrity program as part of the procurement documentation for each weapon system in the contract definition and acquisition phases and subsequent contracts. Normally, an aircraft's structural integrity program calculates damage hours for a given airframe based on mission use data without regard to the moveable components that form the airframe. The Air Force has determined that operating a fleet of aircraft efficiently and effectively requires movement of significant structural members between aircraft, such as landing gear, wings, and tail components. Based on experience of the C-130 and C-141 aircraft, the Air Force has gone to parts life tracking under the Aircraft Structural Integrity Program for the transport aircraft. The structural life management of the C-17 aircraft could be handled in the same manner as the C-130 and C-141 aircraft within the Aircraft Structural Integrity Program.

Individual Part Tracking. The structural integrity program, as implemented for the C-17 fleet, reports data of parts use by aircraft tail numbers for set timeframes. That method assumes that all parts on an aircraft have the same amount of use as the aircraft on which they are installed. Historically, the Air Force has found that reporting by tail number is not sufficient and that tracking use by parts has been necessary because parts are invariably interchanged between aircraft.

Appendix F. Consideration Received for Waivers

Aircraft Number	Waiver Number	Date Waiver Granted	Amount of Consideration
1	WAV-0261R1C1	March 25, 1992	$ 1,000
2	WAV-0322	June 4, 1992	1,000
3	WAV-0362	August 27, 1992	1,000
4	WAV-0454	December 1, 1992	1,000
5	WAV-0542	February 18, 1993	1,000
6	WAV-0649C1	May 4, 1993	1,000
7	WAV-0770	July 8, 1993	3,860
8	WAV-0885	September 13, 1993	1,000
9	WAV-0940	December 28, 1993	1,000
10	WAV-1089	February 8, 1994	1,000
11	WAV-1146	April 1, 1994	1,000
12	WAV-1196	May 9, 1994	1,000
13	WAV-1228	June 23, 1994	1,000
14	WAV-1261	August 3, 1994	1,000
15	WAV-1299	September 26, 1994	1,000
16	WAV-1328	November 16, 1994	11,650
17	WAV-1343	December 20, 1994	1,000
18	WAV-1368	January 27, 1995	1,000
19	WAV-1397	March 29, 1995	1,000
20	WAV-1416	June 12, 1995	1,000
21	WAV-1435	July 27, 1995	1,000
22	WAV-1481	September 20, 1995	1,000
23	WAV-1507	November 15, 1995	1,000
24	WAV-1517	January 24, 1996	1,000
25	WAV-1521	March 25, 1996	1,000
26	WAV-1538	May 28, 1996	1,000
27	WAV-1553	July 3, 1996	1,000
Total Consideration			**$40,510**

Appendix G. Report Distribution

Office of the Secretary of Defense

Under Secretary of Defense for Acquisition and Technology
  Deputy Under Secretary of Defense (Logistics)
  Director, Defense Logistics Studies Information Exchange
  Director, Strategic and Tactical Systems
Under Secretary of Defense (Comptroller)
  Deputy Chief Financial Officer
  Deputy Comptroller (Program/Budget)
Assistant Secretary of Defense (Public Affairs)

Department of the Army

Assistant Secretary of the Army (Financial Management and Comptroller)
Auditor General, Department of the Army

Department of the Navy

Assistant Secretary of the Navy (Financial Management and Comptroller)
Auditor General, Department of the Navy
Department of Navy, Superintendent, Naval Postgraduate School

Department of the Air Force

Assistant Secretary of the Air Force (Acquisition)
Assistant Secretary of the Air Force (Financial Management and Comptroller)
  Program Executive Officer, Tactical and Airlift Programs
Commander, Air Force Materiel Command
  Aeronautical Systems Center
    Program Director, C-17 System Program Office
  Director, San Antonio Air Logistics Center
  Director, Warner Robins Air Logistics Center
Commander, Air Mobility Command
Auditor General, Department of the Air Force

Other Defense Organizations

Director, Defense Contract Audit Agency
Director, Defense Logistics Agency
  Director, Defense Contract Management Command
Director, National Security Agency
  Inspector General, National Security Agency
Inspector General, Defense Intelligence Agency

Non-Defense Federal Organizations and Individuals

Office of Management and Budget
Technical Information Center, National Security and International Affairs Division, General Accounting Office

Chairman and ranking minority member of the following congressional committees and subcommittees:

  Senate Committee on Appropriations
  Senate Subcommittee on Defense, Committee on Appropriations
  Senate Committee on Armed Services
  Senate Committee on Governmental Affairs
  House Committee on Appropriations
  House Subcommittee on National Security, Committee on Appropriations
  House Committee on Government Reform and Oversight
  House Subcommittee on National Security, International Affairs, and Criminal Justice, Committee on Government Reform and Oversight
  House Committee on National Security

Part III - Management Comments

Department of the Air Force Comments

DEPARTMENT OF THE AIR FORCE
WASHINGTON, DC

Office of the Assistant Secretary

28 JAN 1997

MEMORANDUM FOR ASSISTANT INSPECTOR GENERAL FOR AUDITING, OFFICE OF THE INSPECTOR GENERAL, DEPARTMENT OF DEFENSE

FROM: SAF/AQC
1060 Air Force Pentagon
Washington, DC 20330-1060

SUBJECT: DoD IG Draft Report on Waivers and Deviations for the C-17 Aircraft (Project No. 6AE-0033.01)

This is in reply to your request for Air Force comments on the subject report. The C-17 System Program Office (SPO) and Contractor concur with the findings of the draft report. The plan of action outlined in the attached SPO response, along with specific comments to clarify key points, constitute the Air Force Response as approved by AFPEO/AT.

Stephen P. Busch
STEPHEN P. BUSCH, Col, USAF
Chief, Programs Division
Deputy Assistant Secretary (Contracting)
Assistant Secretary (Acquisition)

Attachment:
SPO Comments

cc:
AFPEO/AT
ASC/YC

Final Report Reference

(Referenced notes are on page 36.)

COMMENTS ON WORKING DRAFT OF PROPOSED AUDIT REPORT ON WAIVERS AND DEVIATIONS FOR THE C-17 AIRCRAFT

GENERAL COMMENT:

The C-17 System Program Office and Contractor agree and will comply with all management actions identified in the draft audit report dated 22 Nov 96. This will take the form of an LRU Tracking System (LTS) to be implemented by the prime contractor.

The attached time-phased milestone charts show specific actions and times when serialization implementation will occur. Complete traceability of serialized numbers and parts tracking will be identified and captured as airframe fracture-critical and landing gear life-limited parts are now installed. The back-filling of numbers is scheduled to be completed by 31 Dec 97.

SPECIFIC COMMENTS:

Page 2 - Second paragraph, last sentence - Change "$45.4 billion" to "$41.5 billion in Then Year dollars". — Revised.

Reason: Correction.

Page 2 - Last paragraph, 1st sentence - Delete "_through parts serialization". The listed objectives for ASIP are achieved independent of parts serialization. Parts serialization is one of many tools an ASIP manager uses for fleet management. — Deleted.

Reason: Clarification

Page 4 - Paragraph 1, 1st sentence - Comment: Serialization data for the first 17 aircraft were available at the time of the audit but were not requested by the audit team. The audit team requested only data on the last 10 aircraft (P18 - P27). The team stated that if data on the first 17 aircraft were required, it would be requested through proper channels. — Note 1.

Reason: Clarification

Page 4 - Paragraph 1 - Comment: MDC-MTA disagrees that the average number of 32 for the 109 fracture critical parts was not available. By count, the number was 23 of the 109 that were not READILY available in the data base. During the audit, a miss count of 23 vs 32 was identified for the inspectors, but was disregarded. The draft report states 32 as the number, which includes parts that are double counted. The double count is attributed to identical part numbers listed more than once with different dash numbers. — Note 2.

Final Report Reference

(Referenced notes are on page 36.)

Reason: Accuracy and Clarification

Page 4 - 1st paragraph, 2nd Bullet - Comment: Initially, the vendors were required to maintain serial numbers and information concerning the manufacture of fracture critical parts at their facilities. MDC-MTA has since amended that requirement and is now flowing a Supplier Data Requirements List to vendors requiring submittal of serialization and manufacturing data with each delivery on DAC 26-902 (Rev. 6-93) "Fracture Critical Cat A & B Parts Data Log".

Agree. Air Force comments provide explanatory information not included in the audit report.

Reason: Clarification

Page 4 - Last paragraph, 3rd, 4th, and 5th sentence - Change "will " to "*may*" in three locations. There is no certainty that the events cited "will" occur in the future.

Revised.

Reason: Clarification

Page 4 - Paragraph 1, 2nd sentence - Delete the figures pertaining to the landing gear, as they are erroneous and were not requested nor provided to the auditors.

Note 3.

Reason: Clarification

Page 5 - Paragraph 1, 1st and 2nd sentence - Comment: MIL-A-83444, paragraph 6.2.6 was used to determine which parts required serialization on the C-17. A total of 850 parts were required to be serialized using MIL-A-83444. The 1,280 cited in the report includes additional serialized parts (850 required + 430 additional = 1,280 serialized parts per C-17) for ease of tracking. These additional parts include items such as Time Change items (Batteries, explosive cords, etc.), and Line Replaceable Units. The 850 required parts list includes the 20 landing gear parts, "reliability critical", and 109 "fracture critical", safety of flight parts.

Agree. Air Force comments provide explanatory information not included in the audit report.

Reason: Accuracy and Clarification

Page 5 - Note 2, 2nd line - Change: _"fracture-critical"_ to "*safety of flight.*"

Revised.

Reason: Clarification

Page 5 - Note 2, 3rd line - Change: _"sufficient reliability levels that they can be relied on as not being fracture-critical" to " *sufficient reliability levels that they cannot be relied on to meet their overall life goal without significant supportability costs.*"

Revised.

Reason: Clarification

2

Final Report Reference

(Referenced notes are on page 36.)

Page 6 - Paragraph 1, 2nd sentence - Comment: Serialization data for the first 17 aircraft were available at the time of the audit but were not requested by the audit team. The audit team requested only data on the last 10 aircraft (P18 - P27). The team stated that if data on the first 17 aircraft were required, it would be requested through proper channels.

Reason: Clarification

Note 1.

Page 6 - Paragraph 2, 2nd sentence - Change "parts as fracture critical" to "*parts as safety of flight*".

Reason: Accuracy

Revised.

Page 6 - Paragraph 2, 6th sentence - Comment: Delete the figures pertaining to the landing gear, as they are erroneous and were not requested nor provided to the auditors.

Reason: Clarification

Note 3.

Page 8 - Paragraph 2 - General Comment: The Aircraft Structural Integrity Program (ASIP) allows the inclusion of non-safety, critical structure on the fracture critical part list if the part is expensive or difficult to replace, and the contractor desires additional control of the part during manufacturing. The inboard flap-support assembly (cited in this paragraph), and several large forgings on the list, fall into this category. Only two components that contain fracture critical parts have been identified as potentially movable -- the horizontal tail and the flaps as noted on pages 7 & 8. The horizontal tail is already serialized and tracked in G081 and ASIP. Procedures are already in place to pick-up all landing gear component serial numbers when the gear components cycle through their first major overhaul and then continue to track through G081. There are two alternatives for the flap, either remove the flap structure from the fracture critical part list, or track the serial numbers in G081. The contractor has contacted all suppliers. They have collected all available traceability records. They have also been working closely with their suppliers to ensure that the procedures and processes for getting all required serial numbers in the future are established and understood on a part by part basis. The corrective actions on the last five parts on the list are to be completed in December 1996.

Reason: Clarification

Agree. Air Force comments provide explanatory information not included in the audit report.

3

Final Report Reference

(Referenced notes are on page 36.)

Page 9 - 2nd paragraph - Change "did not fully consider" to "could not fully quantify at time of aircraft acceptance".

Reason: Accuracy

Revised.

Page 10 - First sentence of top paragraph - Change to read, "Serialization was believed to be cost effective at the time of award of the full scale engineering development contract, and this requirement was priced into that effort by the contractor."

Reason: Clarification

Revised.
Page 9.

Page 10 - Last sentence of top paragraph - Comment: The contractor does not utilize G081, since the SPO has not yet authorized them to proceed.

Reason: Clarification

Revised.
Page 9.

Page 12 - 5th Bullet - Comment: The contractor will back-fill serial numbers for fracture critical parts. In addition, the contractor is assigning serial numbers to vendors of build to print items.

Reason: Clarification

Agree. Air Force comments provide information not available at the time of the audit.
Page 11.

Page 12, Management Actions:

Additional actions being taken by MDC-MTA and agreed-to by the SPO:

MDC-MTA is implementing a serialization data sheet for use with its Inter-Component Work Order (ICWO) suppliers. This will be an attachment to the ICWO to request serial number assignments from C-17 Configuration Management (CM). All new purchases requiring serialization will have this requirement sheet attached.

MDC-MTA CM has been granted access to the Master Description Screen in the Material Automated Information Network (MAIN), where the purchase orders are generated. Serialization requirements and pre-assignment of serial numbers for non-ICWO suppliers will be printed automatically on the purchase order. Pre-assignment of serial numbers to build-to-print suppliers will provide MDC-MTA inspection verification of compliance.

Agree. Air Force comments provide information not available at the time of the audit.
Page 11.

To handle the serialization requirement at the Crib in/Crib-out function performed on the production floor, a system using a Master Reference Table (MRT) is being initiated.

4

Final Report Reference

MDC-MTA CM is pre-loading the MRT with specific redundant data to ensure greater accuracy and to reduce input time on the shop floor. There will be input "gates" when the part is issued out of the warehouse, and again when issued from the CRIB by Advanced Assembly Outline for installation. The gates will have the MRT serial numbers available and if a non-issued number is installed on a production line aircraft, a database flag will indicate an error has been made. Production line stoppage is at this point. Verification of serial number must be made at once to keep the line moving.

The training of Crib-In/Crib-out and installers is in progress. All purchase requests with the serial number requirements attached have been in effect for two months.

These processes were implemented in December 1996.

Reason: Accuracy and Clarification

Page 19 - Paragraph 1, 1st and 2nd sentence - Change "fracture critical" to "*safety of flight*" in both sentences. — Revised. Page 17.

Rationale: Damage tolerance requirements apply to all safety of flight structure. Fracture critical parts are a subset of safety of flight structure.

Reason: Clarification

Page 19 - Last paragraph - It is the Air Vehicle Specification which requires the serialization of all Cat A & B fracture critical parts, not the Configuration Management Plan. — Revised. Page 17.

Reason: Clarification

Page 24 - Aircraft # P-27 was DD-250'ed on July 3, 1996 and WAV-1553 has a withhold of $1,000. — Revised. Page 22.

Reason: Clarification

5

LRU Tracking System (LTS) Phase 2 Functions

12-11-96

This represents Phase 2 goals for the years 1997 and 1998.

The Time Phased Milestones are identified below by ID #. The ID #s identify lines on the Serialization and Tracking (S & T) scheduler attached. Phase 1 has been implemented, and Phase 2 will be brought on line per the attached schedule.

ID7. Infrastructure Enhancements (computers and software): **Start installation date 12/9/96**

- Installing automated data base reference tables with applicable maintenance and inquiry support transaction and reports to support the following.

  A. Part effectivity validation.
  B. Software to part effectivity validation.
  C. Limited life and usage validation and rules.
  D. Aircraft tracking validation.
  E. Aircraft location to part effectivity validation.
  F. Product Section location validation.
  G. Part location in subassembly validation.
  H. Part covering AO validation.
  I. Contract to part validation.
  J. Facility location validation and tracking.
  K. Part Configuration change validation.
  L. AO tracking.
  M. Report generation definition.
  N. System help facility.
  O. Alternate parts validation.

ID 11. Configuration Functions: **Projected installation date the beginning of August 1997**

- This functionality will use the reference tables to validate part and software change activity as components are altered to produce a different part.
- The functions will also validate the configuration of a part when it is allocated, issued to , and installed on an aircraft to ensure that the part is effective for the fuselage and when installed is effective for the aircraft location.
- The function will also be used to identify and locate installed parts that are no longer effective for specific aircraft.

LRU Tracking System (LTS) Phase 2 Functions

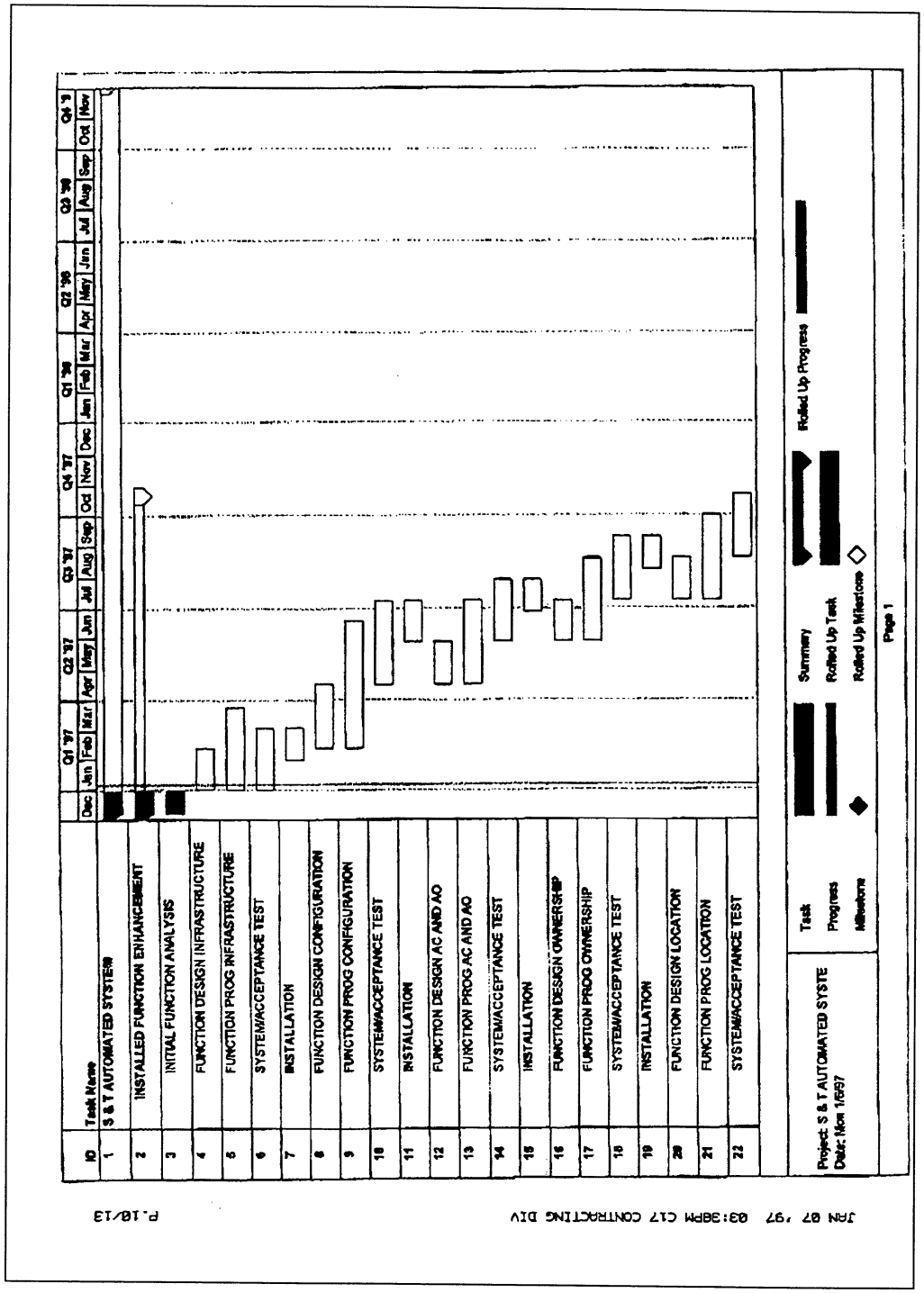
12-11-96

This represents Phase 2 goals for the years 1997 and 1998.

- These functions will be determined and prioritized by the Customer and the LTS Product Integration Team.

ID 46. Client Server Applications: **Projected installation date December 1998**

- To Be Determined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2 INSTALLED FUNCTION ENHANCEMENT
3 INITIAL FUNCTION ANALYSIS
4 FUNCTION DESIGN INFRASTRUCTURE
5 FUNCTION PROG INFRASTRUCTURE
6 SYSTEM/ACCEPTANCE TEST
7 INSTALLATION
8 FUNCTION DESIGN CONFIGURATION
9 FUNCTION PROG CONFIGURATION
10 SYSTEM/ACCEPTANCE TEST
11 INSTALLATION
12 FUNCTION DESIGN AC AND AO
13 FUNCTION PROG AC AND AO
14 SYSTEM/ACCEPTANCE TEST
15 INSTALLATION
16 FUNCTION DESIGN OWNERSHIP
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22 SYSTEM/ACCEPTANCE TEST
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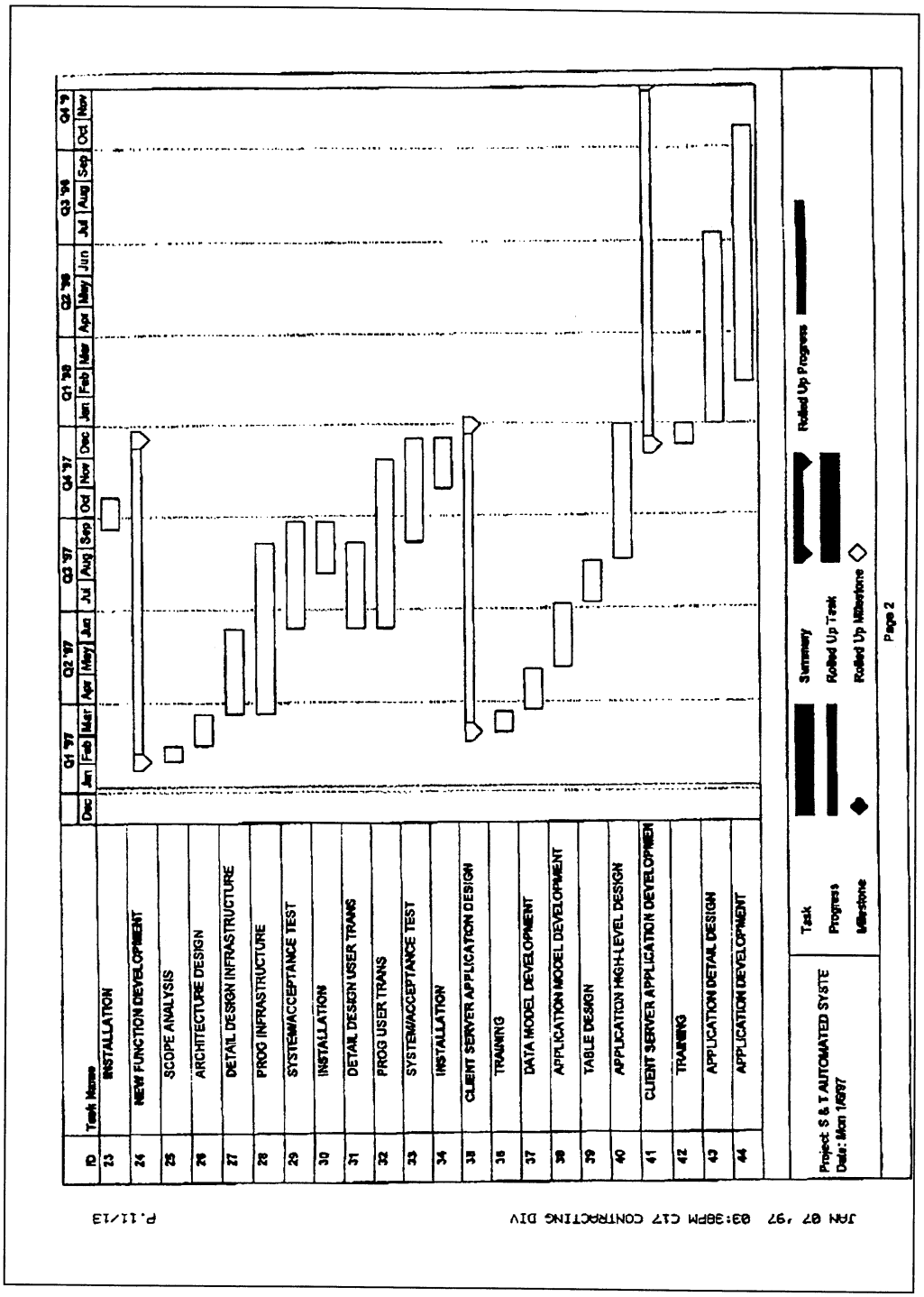
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24 NEW FUNCTION DEVELOPMENT
25 SCOPE ANALYSIS
26 ARCHITECTURE DESIGN
27 DETAIL DESIGN INFRASTRUCTURE
28 PROG INFRASTRUCTURE
29 SYSTEM/ACCEPTANCE TEST
30 INSTALLATION
31 DETAIL DESIGN USER TRANS
32 PROG USER TRANS
33 SYSTEM/ACCEPTANCE TEST
34 INSTALLATION
35 CLIENT SERVER APPLICATION DESIGN
36 TRAINING
37 DATA MODEL DEVELOPMENT
38 APPLICATION MODEL DEVELOPMENT
39 TABLE DESIGN
40 APPLICATION HIGH-LEVEL DESIGN
41 CLIENT SERVER APPLICATION DEVELOPMEN
42 TRAINING
43 APPLICATION DETAIL DESIGN
44 APPLICATION DEVELOPMENT
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Notes: Inspector General responses to specific comments

1. We requested data on the first 17 aircraft. C-17 System Program Office personnel directed us to the prime contractor for the data. The prime contractor informed us that:

o the data were not readily available and that the data would have to be requested from subcontractors,

o the recoupment of those data would require a considerable level of effort by both prime contractor and subcontractors,

o a request for such a level of effort would have to come through the C-17 System Program Office and would increase contract effort and cost, and

o negotiations for a no-cost effort were underway with some subcontractors for the data on the first 17 aircraft at the time of the audit.

Because of the claimed cost burden, the auditors accepted the data for the last 10 aircraft, the data of which were readily available at no additional cost.

2. The prime contractor identified the parts for the auditors' analysis that showed that the contractor did not have parts traceability information for an average of 32 fracture-critical parts for aircraft numbers 18 through 27. We agree that the prime contractor later stated that identical part numbers were included in the analysis, but the prime contractor did not provide data to support the revised numbers. Because the difference of 32 instead of 23 would not change the conclusions drawn by the auditors that improved part serialization was necessary, we issued the report based on the documentation that the contractor provided.

3. The prime contractor provided those figures and supporting data. The document supporting the figures and data is Drawing: 17M9Y0905, Attachment 1, Serialization Working List for C-17A.

Audit Team Members

This report was prepared by the Acquisition Management Directorate, Office of the Assistant Inspector General for Auditing, DoD.

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